Evidence-based early stage type 2 diabetes follow-up in Belgian primary care practices : impact of multi-professional teams and care protocols

Evidence-Based Early Stage Diabetes Follow-Up in Belgian Primary Care Practices: Impact of Multi-Professional Teams and Care Protocols.

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Abstract

Aim
The aim of this research is to explore the current early-stage diabetes mellitus type 2 care in Belgian general practices. This, to find out if the care is provided according to the proposed evidence-based national diabetes care guideline. Additionally, this research aims to detect which person and practice characteristics can be associated with a more evidence-based care provision.

Methods
People were included in the study if they were recently diagnosed with type 2 diabetes by the participating practice. Practice and person characteristics, and clinical parameter monitoring and lifestyle monitoring data were collected by using a questionnaire and a topic list.

Results
A total of 27 general practices participated and a total of 249 people were included through their patient records. People monitored in a practice according to a self-developed protocol were 5.5 times more likely to have a better clinical parameter follow-up. Larger practices (>2000 patients), follow-up by general practitioners and practice nurses together and according to self-developed protocols were associated with a significantly better lifestyle follow-up.

Conclusion
Practices providing multidisciplinary diabetes care, in collaboration with practice nurses, and with diabetes care based on self-developed protocols achieved a more comprehensive follow-up.

Keywords

Diabetes Mellitus type 2 – Primary care – Multidisciplinary collaboration – Care Protocol – Practice nurse

Introduction

The consequences of late detected or poorly diagnosed and monitored diabetes are considerable . The chronic hyperglycemia of diabetes is associated with long-term dysfunction, and failure of the eyes, kidneys, nerves, heart, and blood vessels. Individuals with undiagnosed type 2 diabetes (T2D) are also at significantly higher risk for stroke, coronary heart disease, and peripheral vascular disease [1]. These consequences increase the importance of early detection and a qualitative follow-up. Fortunately, the evidence on optimal care provision for people diagnosed with T2D is numerous. Internationally, this evidence is transferred to clinical guidelines that can be implemented in daily practice, supporting an optimal evidence-based care provision especially when provided by a multi professional team [2, 3]. In Belgium, Domus Medica, the professional organization of general practitioners (GPs), published the Domus Medica guideline for T2D [4]. These guidelines are used not only for clinical management of T2D but also for monitoring of ongoing care with predefined laboratory check-ups at regular times, lifestyle follow-up about diet, exercise, smoking and referral services to various specialists [5, 6]. A comprehensive monitoring requires a considerable time investment from the primary care providers. Partly due to this high workload, a discrepancy remains between what is prescribed by guidelines and the actual care provided in general practices [7].

A survey in the United States of America showed that only 18% of 5 000 included diabetics were getting diabetic care according to the American Diabetes Association's (ADA) recommended targets for Hemoglobin A1c (HbA1c) level, blood pressure and low density lipoprotein (LDL) levels [8]. Similar results were obtained through an Australian survey among 600 diabetics. Only 42% underwent the recommended foot examination and only 20% got lifestyle recommendations [9]. A Pakistani study in 2005 revealed that only 30% of the diabetics got an eye examination, and HbA1c levels were recorded for only 44% of the included diabetics [10]. Another American study revealed that only 7% of 42 837 people diagnosed with DMT2 were monitored entirely correctly for HbA1c, according to ADA guidelines, for one year [11]. A longitudinal cohort study in Luxembourg revealed that, despite 90% of their 21 068 included diabetics consulted their treating physician at least four times per year, only 45% had a HbA1c test and only 31.1% had a renal check-up [12].

Without a doubt, reforms are necessary. Current Belgian primary care practices can no longer cope with the increasing chronic care demands [13]. Belgian GPs are joining forces and group practices are emerging [14, 15]. In addition, other care professionals are starting to join GPs in their practices, such as practice nurses (PNs), psychologists, dieticians and social workers. Belgian education also focuses on the training of PNs by initiating a postgraduate course for PNs [16]. However, the question remains which reforms actually lead to better management of this increased population and, also, to an improved chronic care.

Therefore, it is useful to gain insight in the current diabetes care provided by Belgian general practices and to compare different types of practices, as they present themselves in Belgium, and detect which type(s) of care provision can be associated with an improved diabetes care. With this research the focus lies on the care provided during the first year after diagnosis. A period in which people should be supported extensively, not only in processing the diagnosis, but also in focusing on adapting their lifestyle so secondary prevention or even cure can be achieved.
With this research, we try to provide answers to the following research questions:
- To what extent is the current early stage diabetes care in Belgian general practices provided, according to the proposed evidence-based national diabetes care guideline?
- Which person and practice characteristics can be associated with a more evidence-based care provision?

Methods

Research design and recruitment of general practices

This observational cohort study was conducted from the fall of 2018 till the summer of 2019 in Belgian (Flemish) general practices. A convenience sampling method was used in order to include practices. A total of 138 general practices received a letter and email describing the design, course and importance of the study. Two weeks later, practices were contacted by telephone. During this phone call, the researchers asked about their willingness to participate and answered possible questions. A number of practices were visited in person by the researchers, to discuss their possible participation. A total of 27 practices agreed to participate.

Participants

Through purposive sampling, people were included. They needed to be at least eighteen years old. People were included in the study if they were recently (in the last two years) diagnosed with T2D by the participating practice or when the chronic diabetes care was initialized in the last two years by the participating practice. Only the first year after diagnosis was monitored, but in order to reach a larger population, diabetics who were diagnosed up to two years ago could be included. People diagnosed with Diabetes Mellitus type 1 or gestational diabetes were excluded from the sample. The proposed sample size included 363 patients [17].

Data collection

The data collection was twofold. At first, practices were asked to fill in a 'practice characteristics questionnaire'. Then, the researchers visited the practices to obtain the necessary information through the patient records, using a topic list. (see additional files 1 and 2)

Practice characteristics questionnaire
The questionnaire contained questions about: employed professional caregivers; the payment system, location and size of the practice; the number of active patients diagnosed with T2D; the care provision for people diagnosed with T2D (care providers, screening method, and applied evidence-based protocol)

Topic list
The topic list was divided into three major parts: person characteristics, clinical parameter monitoring and lifestyle monitoring.

Person characteristics
Data was collected regarding: sex, age, nationality, date of T2D diagnosis, smoker, heart- or coronary disease, hypertension, antihypertensive medication, oral antidiabetics, , insulin medication,.

Monitoring of clinical parameters
Following data were collected: weight, body mass index (BMI), abdominal circumference, fasting blood sugar (glycemic control), hemoglobin type A1c (HbA1c), low density lipoprotein (LDL), high density lipoprotein (HDL), total cholesterol, systolic and diastolic blood pressure (BP), serum creatinine to test renal function (eGFR – estimated glomerular filtration rate), albuminuria (presence of the protein albumin in the urine), monofilament test (test to examine feet and possibly detect peripheral neuropathy), referral to ophthalmologist, and referral to other professional caregiver(s).

Lifestyle monitoring

Following data were collected: eating and drinking habits, physical activity, smoking habits, illness experience and provision of psychosocial support.

Person characteristics were collected once, at the start of the data collection. Parameter characteristics and lifestyle items were collected on three different times during the first year after the T2D diagnosis.
If people were diagnosed with T2D, less than a year ago at the time of the researchers' data collection, these participants were excluded from the analyses. After all, these missing follow-up moments were due to the researchers' period of data collection.

Outcome variables

Two outcome variables were calculated; 'clinical parameter follow-up' and 'lifestyle follow-up'.

These outcome variables are based on the Domus Medica guideline for T2D [18]. This guideline proposes an evidence-based follow-up by GPs for people, diagnosed with T2D. This guideline entails a number of parameters to be checked every year. Some need to be checked once, other parameters need to be checked at least three times; once during the annual check and an additional two times during interim checks throughout the year. Table 2 presents the intended follow-up frequency by Domus Medica for every parameter and lifestyle item.

Outcome variable: 'Clinical parameter follow-up'

The outcome variable 'clinical parameter follow-up' was calculated by checking the frequency of follow-up of every parameter for every participant. For every achieved intended frequency per parameter, the person received one point. So, 1 point = follow-up frequency was reported according to Domus Medica guideline, 0 points = insufficient reported follow-up frequency. Participants were scored on thirteen individual parameters, a maximum score of 13 could be achieved when a perfect parameter follow-up occurred.

Outcome variable: 'Lifestyle follow-up'

The outcome variable 'lifestyle follow-up' was calculated by checking the frequency of follow-up of every lifestyle item for every participant. For every reached intended frequency per parameter, the person received one point. Here however, a very limited number of people achieved an 'ideal' lifestyle follow-up, whereby further analyses were not possible. Consequently, the researchers decided if the follow-up for a lifestyle item happened at least once (instead of three times), one point was added. So, 1 point = follow-up was reported at least once, 0 points = follow-up was never reported. Participants were scored on four items, a maximum score of four could be achieved when an adequate lifestyle follow-up occurred.

Data analysis

The researchers chose to compare characteristics between the upper and lower scores of the outcome variables. For clinical parameter follow-up, practice and person characteristics were compared between the 25^{th} percentile and the 75^{th} percentile. For lifestyle follow-up, practice and person characteristics were compared between the least monitored and the most monitored participants. A comparison between the 25^{th} and 75^{th} percentile was not possible due to an uneven distribution of the number of people per group. The outcome variables were both dichotomous.

Differences between categorical or continuous characteristics and the outcome variables were checked by applying respectively the chi-square test and independent samples T-test. Associations between characteristics and the outcome variables were checked by calculating the odds ratios and performing univariate binary logistic regression analyses. Statistical analyses were carried out in the software package SPSS 26 [19]. A p-value of 0.05 or lower was considered statistically significant.

Results

A total of 27 general practices participated in this study and a total of 249 participants were included through their patient records. The person and practice characteristics are described in Table 1.

Table 1: Person and practice characteristics

Person characteristics (n=249)		Practice characteristics (n=27)	
Characteristic	N (%)	Characteristic	N
Sex		Professionals in the practice	N, mean (min-max)
Male	144 (57.8)	GPs/practice	100, 3.7 (1-9)
Female	105 (42.2)	GP trainees	32, 0.8 (0-2)
		PNs	22, 0.8 (0-4)
		Administrative assistants	40, 1.5 (0-9)
		Included patients/practice	249, 9.2 (1-20)
Age (in years)		Payment system	
Mean (SD)	60.6 (14.5)	Capitation based	5
Min-max	22-96	Fee for service	22
Smoker		Location	
Yes	42 (16.9)	Rural area	12
No	159 (63.9)	City	15
Missing in file	48 (19.3)		
Cardiovascular disease		Size of the practice (n=26)	
		<1000 patients	2
Yes	71 (28.5)	1000-1499 patients	3
No	178 (71.5)	1500-1999 patients	3
		>2000 patients	18
Hypertension		Number people with T2D	Mean (min-max)
Yes	97 (39.0)	(n=20, 7 missing)	188.9 (12-600)
No	152 (61.0)		
Hypertension medication		Number new T2D diagnoses/year (n=18, 9 missing)	Mean (min-max) 20.4 (2-100)
Yes	91 (36.5)		
No	158 (63.5)		
Genetic predisposition		People with T2D consulting most frequently with (n=26)	
Yes	36 (14.5)		
No	66 (26.5)	GP	16
Unknown	5 (2.0)	PN	7
Missing in file	142 (57.0)	Both GP and PN	3
Oral medication		Screening for diabetes	
Yes	196 (78.7)	Yes	13
No	53 (21.3)	No	14
Time between diagnosis and start		Screening tool used (n=13)	
		FINDRISC	3

oral medication (in days) (n=196) Mean (SD) Min-max	 51.17 (117.531) 0-944	Self-developed Other Missing	3 6 1
Insulin medication Yes No	 9 (3.6) 240 (96.4)	Reason no screening for diabetes Lack of financing Lack of time Other	 2 11 1
Referral ophthalmologist Yes No	 83 (33.3) 166 (66.7)	Protocol used for T2D follow-up Yes No	 23 4
Referral other care professionals - Dietician - Podiatrist - Endocrinologist - Cardiologist - Diabetes educator - Dentist	 57 (22.9) 10 (4.0) 22 (8.8) 3 (1.2) 5 (2.0) 0 (0)	Which protocol is used for T2D follow-up (n=23) Domus Medica Diabetes Liga Self-developed Combination Other	 6 2 5 9 1
		Protocol (partially) based on Domus Medica Diabetes Liga Self-Developed Other • ADA guidelines • Domus Medica +NICE+Canadian guidelines • NHG • RIZIV	 12 9 8 5 1 1 2 1

GP(s): General Practitioner(s)
PN(s): Practice Nurse(s)
T2D: Diabetes Mellitus Type 2
ADA: American Diabetes Association
NICE: National institute for health and care excellence
NHG: Nederlands Huisartsen Genootschap – Dutch General Practitioner Association
RIZIV: RijksInstituut voor Ziekte- en InvaliditeitsVerzekering/National Institute for Health and Disability Insurance

Clinical parameter and lifestyle follow-up

Table 2 provides an overview of the actual reported follow-up frequency of all clinical parameters and lifestyle items, included in the outcome variables. For example, the parameter 'weight' needs to be monitored three times during the first year after diagnosis. For 19.7% of the participants, this follow-up frequency was reported in their patient records. For 27.4% of the participants, their weight monitoring was never reported during the first year after diagnosis.

Table 2: degree of clinical parameter and lifestyle follow-up			
Clinical parameter follow-up (n=208)			
Parameter	Guideline frequency – intended follow-up (per year)	Perfect follow-up – according to guideline frequency N (%)	Never monitored N (%)
1. Weight	3	41 (19.7)	57 (27.4)
2. Body Mass Index (BMI)	1	122 (58.7)	86 (41.3)
3. Abdominal circumference	1	33 (15.9)	175 (84.1)
4. Glycemic control	3	108 (51.9)	4 (1.9)
5. HbA1c	3	122 (58.7)	2 (1.0)
6. Low density lipoprotein (LDL)	3	25 (12.0)	17 (8.2)
7. High density lipoprotein (HDL)	3	34 (16.3)	24 (11.5)
8. Total cholesterol	3	35 (16.8)	16 (7.7)
9. Systolic blood pressure	3	73 (35.1)	18 (8.7)
10. Diastolic blood pressure	3	73 (35.1)	18 (8.7)
11. Creatinine (eGFR)	1	178 (85.6)	30 (14.4)
12. Albuminuria	1	57 (27.4)	151 (72.6)
13. Feet check/monofilament test	1	40 (19.2)	168 (80.8)
Lifestyle follow-up (n=208)			
Lifestyle item	Guideline frequency (per year)	Perfect follow-up – according to guideline frequency N (%)	Never monitored N (%)
1. Discuss nutrition and/or provide nutritional advise	3	69 (33.2)	64 (30.8)
2. Discuss physical activity and/or provide physical exercise advise	3	50 (24.0)	79 (38.0)
3. Discuss smoke cessation and/or provide smoke cessation advise	1	9 (4.3)	199 (95.7)
4. Discuss illness experience – psychosocial support	3	21 (10.1)	83 (39.9)

HbA1c: Hemoglobin Type A1c

A total of 208 people were included in the further analyses. 41 people were excluded due to the data collection period of the researchers. The outcome variable 'clinical parameter follow-up' (n=208) contained thirteen parameters. The average follow-up score was 6.80 with a 2.54 standard deviation (SD) and a min-max score of 0-13. The 25th percentile contained 66 people (31.7%), with a parameter score of zero till five out of thirteen. The 75th percentile contained 60 people (28.9%), with a parameter score of nine till thirteen out of thirteen. The outcome variable 'lifestyle follow-up' (n=208) contained four parameters. The average follow-up rate was 1.76 with a 1.33 SD and a min-max score of 0-4. The least monitored people (N=90, 43.3%) scored zero till one out of four, the most monitored people (N=93, 44.7%) scored three till four out of four.

Differences in characteristics with clinical parameter follow-up

Table 3 describes the difference in characteristics between the least and most correctly monitored people in terms of parameter control. Four characteristics differ significantly between the 25th and 75th percentile for ideal clinical parameter follow-up. People who were monitored in a practice with a practice nurse are 2.38 times more likely to belong to the 75th percentile of clinical parameter follow-up. The odds of people to belong to the 75th percentile, were 5.8 times bigger when monitored in a practice according to a T2D protocol and 5.5 times bigger when monitored in a practice according to a self-developed T2D protocol.

Table 3: Clinical parameter follow-up: comparing 25th and 75th percentile. (N=126)			
Characteristics	P25 n=66 (in %)	P75 n=60 (in %)	Odds ratio (95% CI)
Person characteristics			
Sex $ Male Female	 62.1 37.9	 66.7 33.3	 0.820 (0.394- 1.705)
Age (in years) €	Mean: 60.79	Mean: 59.36	0.993 (0.968-1.018)
Duration T2D till start medication (in days) €	Mean: 72.29	Mean: 36.23	0.998 (0.994-1.001)
Smoker (n=184) $	20.0	19.2	0.952 (0.358-2.532)
Genetic predisposition $	44.4	38.2	0.774 (0.243-2.465)
Oral medication $	72.7	80.0	1.500 (0.652-3.450)
Practice characteristics			
Type practice $ Monodisciplinary Multidisciplinary	 13.6 86.4	 3.3 96.7	 4.579 (0.948-22.124)
Payment $ Capitation based Fee for service	 22.7 77.3	 31.7 68.3	 0.635 (0.287-1.401)
Location $ Rural City	 36.4 63.6	 38.3 61.7	 0.919 (0.446-1.894)
Size $ <2000 ≥2000	 22.2 77.8	 14.3 85.7	 1.714 (0.659-4.457)
T2D follow-up by $ GP PN	 52.4 25.4	 50.0 38.3	 0.865 (0.672-1.113)

Both GP and PN	22.2	11.7	
T2D follow-up by $ GP Both GP and PN	 52.4 47.6	 50.0 50.0	 1.100 (0.542-2.232)
Practice nurse $ No nurse PN	 34.8 65.2	 18.3 81.7	 **2.38* (1.042-5.448)**
Protocol used $	83.3	96.7	**5.80* (1.230-27.358)**
PN and protocol used $	60.6	81.7	**2.895* (1.276-6.570)**
T2D screening $ Yes	 51.5	 45.0	 0.770 (0.382-1.553)
What protocol$ (n=113) Existing evidence-based Self-developed	 81.8 18.2	 44.8 55.2	 **5.538*** (2.347-13.071)**

GP(s): General Practitioner(s)
PN: Practice Nurse
$ Chi-square test (with continuity correction for a 2x2 table)
€ Independent samples T-test, equal variances not assumed
*** p<0.001, ** p<0.01, *P<0.05

Differences in characteristics with lifestyle follow-up

Table 4 describes the difference in characteristics between the least and most correctly monitored people in terms of lifestyle follow-up. Up to twelve characteristics differ significantly between the least and most correctly monitored people. Odds of a very good lifestyle follow-up diminish when people were older and when more time passed by between the diagnosis and the start with oral antidiabetics. Odds of a good follow-up increased when it was monitored by a multidisciplinary (multiple professions working together) general practice, a large practice (>2000 patients), a GP and a practice nurse, a practice that applies an evidence-based DMT2 protocol, and a practice that applies a self-developed T2D protocol.

Table 4: Lifestyle follow-up: comparing least and most correctly monitored people. (N=183)			
Characteristics	Least monitored n=90 (in %)	Most monitored n=93 (in %)	Odds ratio (95% CI)
Person characteristics			
Sex $ Male Female	 57.8 42.2	 59.1 40.9	 0.945 (0.525-1.702)
Age (in years) €	Mean: 63.12	Mean: 58.55	**0.978* (0.959-0.999)**
Duration T2D till start medication (in days) €	Mean: 83.13	Mean: 34.59	0.996* (0.992-0.999)
Smoker (n=147) $	15.0	21.8	1.583 (0.662-3.788)
Genetic predisposition $	42.3	27.8	0.524 (0.197-1.397)
Oral medication $	78.9	80.6	1.115 (0.542-2.295)
Practice characteristics			
Type practice $ Monodisciplinary Multidisciplinary	 15.6 84.4	 0.0 100.0	 **2.22*** (1.882-2.627)**

Payment $			
Capitation based	14.4	35.5	**0.307** (0.149-0.634)**
Fee for service	85.6	64.5	
Location $			
Rural	41.1	47.3	0.777 (0.433-1.395)
City	58.9	52.7	
Practice size $			
<2000	31.7	3.4	**13.31*** (3.846-46.065)**
≥2000	68.3	96.6	
T2D follow-up by $			
GP	72.9	43.0	**1.268*** (1.000-1.607)**
PN	15.3	41.9	
Both GP and PN	11.8	15.1	
T2D follow-up by $			
GP only	72.9	43.0	**3.572*** (1.901-6.710)**
Both GP and PN	27.1	57.0	
Practice nurse $			
No nurse	46.7	18.3	**3.912*** (2.003-7.639**)
PN	53.3	81.7	
Protocol used $			
No protocol	23.3	4.3	**6.772*** (2.222-20.641)**
Protocol	76.7	95.7	
PN and protocol used $	47.8	81.7	**4.886*** (2.503-9.540)**
T2D screening $			
Yes	55.6	38.7	0.505* (0.280-0.911)
What protocol $ (n=158)			
Existing evidence-based	82.6	39.3	**7.329*** (3.448-15.576)**
Self-developed	17.4	60.7	

GP(s): General Practitioner(s)

PN: Practice Nurse

$ Chi-square test (with continuity correction for a 2x2 table)

€ Independent samples T-test, equal variances not assumed

*** p<0.001, **p<0.01, *p<0.05

To analyze if person and practice characteristics act together on the tendency to monitor lifestyle items, we fitted a stepwise forward binary logistic regression model (see Table 5). Larger practices, T2D follow-up by GPs and PNs together and according to self-developed protocols were associated with a more adequate lifestyle follow-up.

Table 5: Binary logistic regression analysis for lifestyle follow-up – Nagelkerke R square: 0.570.

Characteristic	B	SE	Sig	Odds Ratio	95% CI lower – Upper
Age	-0.049	0.022	0.026	**0.952***	**0.913-0.994**
Size practice ≥2000 patients	2.010	0.956	0.036	**7.463***	**1.145-48.627**
T2D follow-up by GP and PN	1.843	0.711	0.010	**6.318***	**1.568-25.462**
Screening for T2D	-1.578	0.630	0.012	**0.206***	**0.060-0.709**

Self-developed T2D protocol	2.661	0.745	<0.001	**14.315*** **	**3.321-61.703**

T2D: Type 2 Diabetes
GP: General Practitioner
PN: Practice Nurse
*** p<0.001, **p<0.01, *p<0.05

Discussion

A remarkable discrepancy was found between the follow-up compliance of clinical parameters checked by blood samples and the follow-up compliance of parameters and lifestyle items that were performed manually by the care providers. This supports the presumption that general practices are more adept at regularly following diabetes through a blood test than through performing a more comprehensive diabetes follow-up, including: 'discussing lifestyle', 'performing monofilament test', 'weighing' and 'measuring abdominal circumference'. It is remarkable that those easy-to-do tests were carried out so limited. These findings are alarming as research shows that lifestyle interventions not only cause sustainable lifestyle changes, but also a reduction in diabetes incidence, which remains after lifestyle follow-up has stopped [20].

Collaboration between GPs and PNs improved both clinical parameter and lifestyle follow-up, and this positive impact has been well documented [21]. Specifically for chronic disease care, research shows the quality of care provided by nurses is at least as equivalent to care provided by physicians [22, 23]. This knowledge makes it all the more relevant to overcome the existing barriers to interprofessional collaboration in primary care, such as the awareness of one another's roles and competences, shared information, confidentiality and responsibility, interprofessional training, long-term funding and joint monitoring [24].

Both care protocols and well-maintained patient records can, at least partially, overcome these existing barriers. Clinical record keeping is a crucial component in good professional practice and the delivery of quality healthcare. Remarkably, GPs were often unaware of the number of people diagnosed with T2D linked to their practices. Well-kept patient records should enable continuity of care and should enhance communication in multi-professional teams, within primary care and between primary and secondary care [25, 26]. In addition, patient and physician recall of a consultation frequently differ. Research indicates that both parties' recall of consultations is poor and that the assumption that professional recall of consultations is more accurate, is insufficiently substantiated [27, 28]. This only increases the importance of well-maintained patient records.

In addition, collaboration is supported by the protocols, which are handled as guidelines, in support of a care that is carried out jointly [3]. Continuity in care is particularly important in chronic disease management, since the care for these people requires optimal coordination and communication between the different professionals involved. Guidelines facilitate this continuity in care [29].

Also, when GPs and PNs collaborate, guidelines are applied more often to the local context of the practice, resulting in self-developed protocols. By adapting the standard evidence-based guidelines to their own context, guidelines come alive and are translated into daily practice. Not as something that needs to be achieved, but as a starting point, from which care can be delivered and if needed, adapted to specific circumstances or patient situations [30].

Limitations

Selection bias might be present in our study since practices that already invest in a comprehensive diabetes care were more likely to participate in a study evaluating diabetes follow-up. By interpreting the results of this study it is important to keep in mind that the results are solely based on the content of the patient records. In addition, practice characteristics related to the provided care were collected through questionnaires, not through observation. 249 participants were included, linked to 27 general practices. A higher response rate might provide a more reliable view on the influencing practice characteristics. We studied various general practice characteristics and its associations with outcome variables (see Tables 1, 3 and 4) and selected significant characteristics to fit a regression model (Table 5), and therefore we did not study cluster effects at general practice level [31]. Not all aspects of a comprehensive diabetes care were included in this study. Vaccinating and providing vaccination advise for example were not monitored. Also, providing T2D education (not linked to eating/drinking habits, smoking and physical activity) was not monitored during this study.

Further research

The present care protocols for T2D may not fully meet current peoples' needs. Research indicates that people diagnosed with T2D value continuous access to services, adapted to their evolving needs. This includes being informed of their test results, and having access to multi-disciplinary services and diabetes education services [32]. This implies the importance of lifestyle follow-up, but also the follow-up by a multidisciplinary team where, by a thorough interdisciplinary communication, continuity in care can be guaranteed – even when provided by different health care professionals. A more goal oriented approach is suggested to better meet peoples' evolving needs [33]. Further research is necessary to determine if care provision according to individual health needs can lead to a more qualitative care provision and to what extent this approach is feasible for primary care. In an over-burdened primary care context, it can be questioned whether the proposed evidence-based follow-up frequencies are still sufficiently aligned with the current primary care context and needs.

Conclusion

Discrepancies between evidence-based diabetes care and current care, provided by Belgian general practices are significant. Especially the limited extent to which lifestyle follow-up is being implemented is worrying. Practices providing multidisciplinary diabetes care, in collaboration with PNs, and with diabetes care based on self-developed protocols achieved a more comprehensive follow-up.

Abbreviations

ADA: American Diabetes Association
BMI – Body Mass Index
BP – Blood Pressure
T2D – Diabetes Mellitus Type 2
eGFR – estimated glomerular filtration rate
GPs – General Practitioners
HbA1c – Hemoglobin type A1c
HDL – High density lipoprotein
LDL – Low density lipoprotein
NHG – Nederlands Huisartsen Genootschap / Dutch General Practitioner Association
NICE – National Institute for health and Care Excellence
PNs – Practice Nurses

RIZIV – RijksInstituut voor Ziekte en InvaliditeitsVerzekering / National Institute for Health and Disability Insurance
SD – Standard Deviation

Declarations

Declarations of interest
None

Ethics approval and consent to participate
The ethics committee of Antwerp university hospital provided a positive advise for this study (Additional file 3). Participation in this study was entirely voluntary. GPs were informed about this study by an information letter and email. In addition, practices were contacted by phone, allowing possible participants to ask us remaining questions. An informed consent was presented when GPs decided to participate, including information on pseudonymisation of the collected data and the possibility to opt out of the study at any given time. During the entire research period, the researchers remained available for answering possible questions of participants. Personal and other data have been pseudonymised to make identification impossible.

Availability of data and materials
The datasets generated and analysed during the current study are available in the Figshare repository, 10.6084/m9.figshare.12073251.

Competing interests
The authors declare that they have no competing interests. The authors alone are responsible for the content and writing of this article. 'Wit-Gele Kruis van Antwerpen vzw' has no role in the design of the study and collection, analysis, and interpretation of data in writing the manuscript.

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Authors' contributions
EM, SB en LV designed the practice questionnaire and topic list, and collected the data. EM, PVB and RR contributed in writing the manuscript. All authors read and approved the final manuscript.

Additional files
Additional file 1: Practice questionnaire
Additional file 2: Topic list
Additional file 3: Approval ethics committee

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